# Understanding cognitive functions related to driving following kava (*Piper methysticum*) use at traditional consumption volumes

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## Introduction

- Kava (*Piper methysticum*) is a traditional culturally significant Pacific Island beverage.
- Kava produces soporific relaxant non-hallucinogenic effects similar to Benzodiazepine.
- Kava blocks the calcium ion channels related to a reduction of neurotransmitter release excitation, potentiates $GABA_A$ through enhanced ligand binding to GABA receptors, reduces the neuronal reuptake of noradrenaline and possibly dopamine, and reverses monoamine oxidase (MAO) B inhibition[1].
- The majority of kava psychopharmacology knowledge results from studies at pharmaceutically recommended doses <300mgs kavalactones per day.
  - Reaction time research at <300mgs kavalactones is inconsistent, ranging from "significantly increased" response accuracy to a 40% reduction in "reaction time … in comparison to placebo"[2].
- Traditionally influenced drinking sessions average six hours in which users consume 3.6 litres (6.33 pints) of liquid kava and 8,000mgs of kavalactones[3].

**Kava plant ready for harvest**

(Aporosa, 2009)

**Kava ready for drinking**

(Henry, 2017)

- It is estimated 70% of kava users in New Zealand (NZ) and Australia drive following high traditionally influenced kava use[4].
- A Fijian based ethnographic study reported a "four-fold increase in the odds of crash involvement" following consumption of kava at cultural volumes[5].
- The Institute of Environmental Science and Research (NZESR) report increased detection of kavalactones in the blood of motor vehicle accident victims[6]. However, due to limited understanding of kava at high consumption volumes, the ESR are unable to provide expert opinion on these findings.
- NZ Police suspect that some unsafe driving is linked to kava use at high volumes.
- Currently there are no roadside tests which detect kava use.
- NZESR and Police have requested research on kava and driving safety.

**Traditionally influenced kava drinking environment**

(Henry, 2017)

### Aim

To measure reaction time and divided attention during and immediately following traditionally influenced kava consumption.

### Hypothesis

Kava consumers (active group) show changes in (1) reaction time and (2) divided attention compared with the control group.

## Methods/Measures

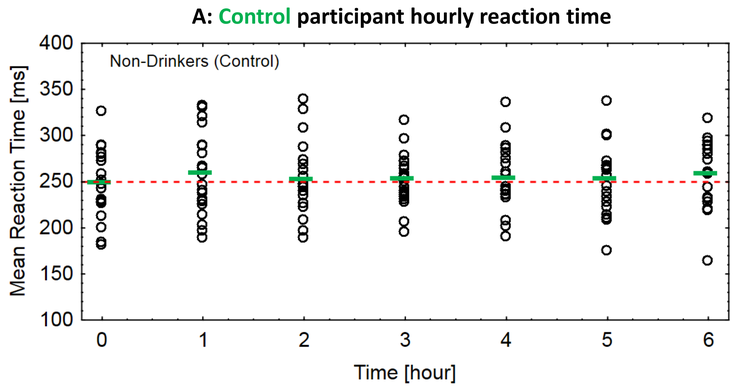
- 40 participants.
- **Active** (kava consumers), n=20 [18 male/2 females], mean age = 35.35.
- **Control**, n=20 [18 male/2 females], mean age = 35.1.
- Seventy-two litres (19.02 gallons) of pre-prepared kava (originating from Tonga and purchased from a well-patronised kava supplier in Hamilton, New Zealand) consumed by participants over the six hour test period.
- Kava sampled: strength rating of 9.26% total kavalactones by dry weight, a chemotype of 423651, no adulteration, mean kavalactone content of 145mg per 100ml of kava beverage.
- All participants screened for neurological and psychological conditions, use of anxiolytic and/or sleep medication, and adhered to washout periods.
- Baseline and hourly computerised tests using Vienna Test System: Traffic's WAFA Alertness (reaction time) and WAFG Divided Attention (perception and attention).
- Pre/post statistical analysis conducted comparing within person and between group change.

## Results

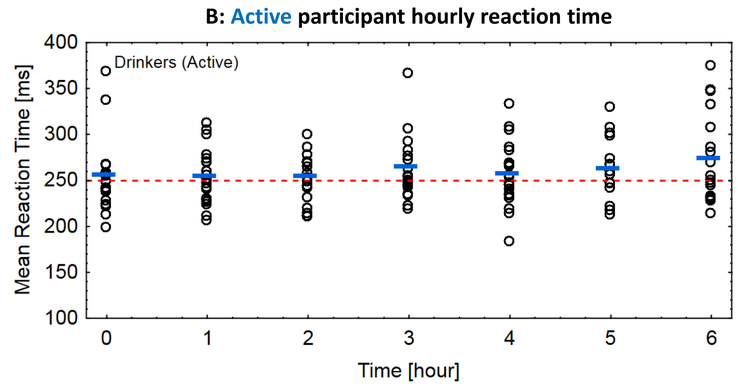
### Reaction Time

- No statistically significant ($p>0.05$) difference within person or between groups at any measurement point over the six hour test period [p=0.868].
- Final test (after six hours) mean reaction time: **control** – 256.70msec (SD=36.86); **active** – 271.8msec (SD=46.32); 15.1msec difference.
- Figure C shows the change in an individuals mean reaction time from baseline correlated with volume of kava consumed. Positive values indicate slower reaction time and negative values faster.

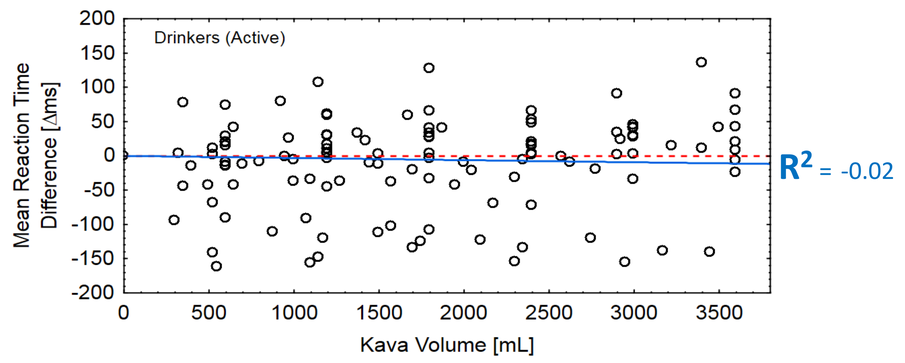
**A: Control participant hourly reaction time**




**B: Active participant hourly reaction time**



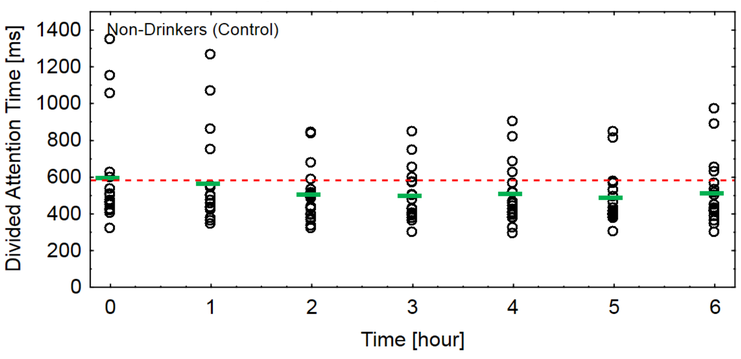

**C: Change in individual mean reaction time from baseline with kava consumption**



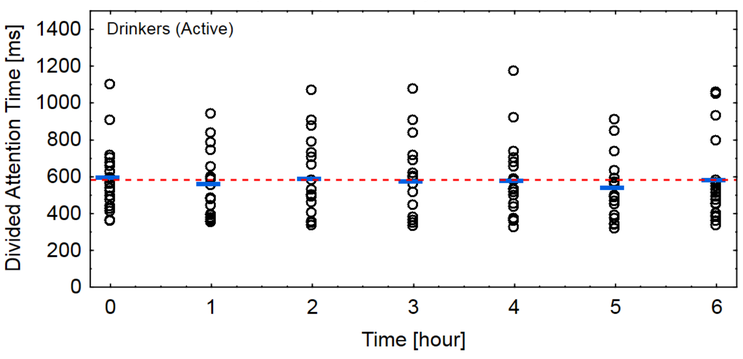

### Divided Attention

- No statistical significant ($p>0.05$) difference within person or between groups at any measurement point over the six hour test period [p=0.624].
- Final test (after six hours) divided attention time: **control** – 499.75msec (SD=167.62); **active** – 568.32msec (SD=217.71); 68.57msec difference.
- Figure F shows the change in an individuals mean divided attention time from baseline correlated with volume of kava consumed. Positive values indicate slower divided attention and negative values faster.

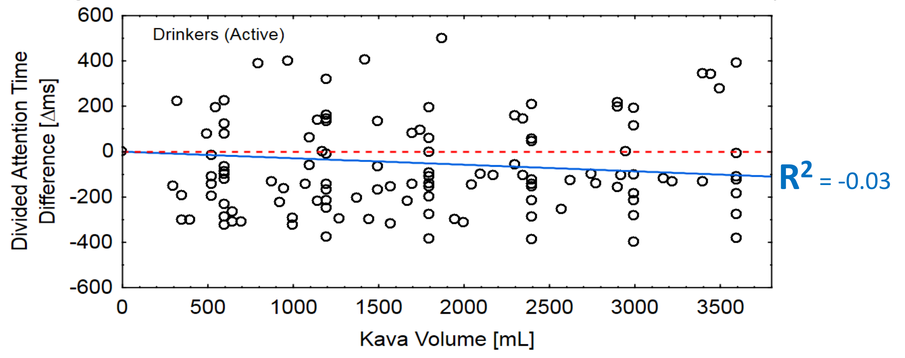
**D: Control participant hourly divided attention time**




**E: Active participant hourly divided attention time**




**F: Change in individual divided attention time from baseline with kava consumption**




## Discussion/Conclusion

- As the six-hour tests session progressed, subtle changes were observed in many of the kava drinker's, namely psychomotor slowing, a somnolent-like state, altered word pronunciation and a slowing of speech rate.
- The test results were not statistically significant for either reaction time or divided attention measures. To give some context to the reaction time difference found in this study with kava (active 22.10msec slower than mean after 6 hours), consuming 50mg of alcohol (equivalent to the current 0.05 NZ driver blood alcohol limit) slowed driver reaction time by 70msec, which increased to 120msec at 0.08 (the previous limit)[7].
- Discordant to hypothesis, the findings show no correlation between consuming kava at traditional volumes and response latency or impairment on divided attention tasks.
- It is possible the measures selected for this study lacked sensitivity in detecting kava's effect.

## Future Directions

- A follow-up study will utilise a highly sensitive somato-sensory assessment tool to measure multiple strategic, tactical and operational cognitive aspects including fine-motor-skills and fatigue, factors argued to be critical in gaining a broad understanding of driver capacity and performance. Additionally, this approach has been selected to allow for kava's action on the central nervous system.

## References

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## D14

### UNDERSTANDING COGNITIVE FUNCTIONS RELATED TO DRIVING FOLLOWING KAVA (PIPER METHYSTICUM) USE AT TRADITIONAL CONSUMPTION VOLUMES

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Introduction: Kava (Piper methysticum), a traditional and culturally significant Pacific Island beverage, produces soporific relaxant effects similar to Benzodiazepine (Sarris et al, 2012, Journal of Human Psychopharmacology Clinical and Experimental, 27:262-9). Traditional users consume this drink at volumes 32 times greater than pharmacologically recommended doses (Aporosa et al, 2014, Anthropologica, 56:163-75), with reports suggesting 70% of users frequently drive following kava use (Maneze et al, 2008, Australian & New Zealand Journal Of Public Health, 32:314-6). Prompted by concerns regarding driver impairment post kava use, this seminal research investigated the effects of kava on two cognitive functions related to driving. Research was based on a traditionally influenced kava session. Methods: Kava consumers (n=20 [18 male/2 females], mean age = 35.35) attended a six hour kava session, each drinking an average 3.52 litres (SD = 0.713 litres) of kava. Also present were a non-kava consuming control group (n=20 [18 male/2 females], mean age = 35.1). At baseline all participants completed computerised tests (Vienna Test System: Traffic WAFA Alertness and WAFG Divided Attention) to assess reaction time, perception and attention. Re-testing was conducted hourly over the six hour period. Pre/post analysis was conducted comparing within person and between group change. Statistical modelling is based on ANOVA and independent t-tests. Results: Data analysis indicated no statistically significant ($p<0.05$) difference between reaction time [$F=(13,264)$, 0.582, $p=0.868$] and divided attention [$F=(13,264)$, 0.834, $p=0.624$] both within person and between groups at any measurement point over the six hour testing period. Mean reaction time and divided attention at baseline was 249.95msec (SD=37.57) and 583.58msec (SD=226k .62) respectively. The control and active group mean reaction times at the final test were 256.70msec (SD=36.86) and 271.8msec (SD=46.32) respectively. The mean divided attention times for the control and active groups at the final test were 499.75msec (SD=167.62) and 568.32msec (SD=217.71). Conclusions: Kava at traditional consumption volumes was not correlated to response latency or impairment on perception and attention tasks. Further research beyond the assessment of these two cognitive functions is required to better understand if kava has any effect on driver ability. Sponsorship: The study is funded by the New Zealand Health Research Council (16/462) and the test battery was generously donated by Vienna Tests Systems, Germany.